Preconception Helicobacter pylori infection might adversely affect pregnancy outcome

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Abstract

**Background:** The association between H. pylori infection, and adverse pregnancy outcomes is still controversial, and no available guidelines recommend screening for H. pylori infection before and/or during pregnancy.

**Objectives:** To detect the incidence of *Helicobacter pylori* (H. pylori) in Egyptian pregnant women, and the adverse pregnancy outcomes associated with H. pylori infection.

**Methods:** Data of 305 pregnant women with regular antenatal follow-up, and complete delivery records were finally analyzed in study to detect the incidence of H. pylori in Egyptian pregnant women, and the adverse pregnancy outcomes associated with H. pylori infection.

The collected blood samples from the studied participants during the antenatal care were used for detection of anti-H. Pylori IgG. Participants were categorized according to anti-H. Pylori IgG to either H. Pylori-positive (study group), or H. Pylori-negative controls. Participants were followed-up in the antenatal clinics till delivery to detect any adverse outcome either during pregnancy and/or during delivery [i.e., hyperemesis gravidarum, iron deficiency anemia, preeclampsia, gestational diabetes mellitus, and preterm deliveries].

**Results:** The incidence of hyperemesis gravidarum, iron deficiency anemia, preeclampsia, gestational diabetes mellitus, and preterm deliveries was significantly higher in the studied H. Pylori-positive group (8.5%, 34.9%, 6.98%, 13.18%, and 10.9% respectively) compared to H. Pylori-negative controls (1.14%, 19.3%, 1.7%, 3.4%, and 3.98% respectively), (P=0.002, 0.01, 0.02, 0.003, and 0.02, respectively). The H. Pylori-positive group had significantly higher odds, and risks of hyperemesis gravidarum [OR 8.1 (P=0.007), and RR 7.5 (P=0.008)], iron deficiency anemia [OR 2.2 (P=0.002), and RR 1.8 (P=0.002)], and preeclampsia [OR 4.3 (P=0.03), and RR 4.1 (P=0.03)] compared to H. Pylori-negative controls.

The H. Pylori-positive group had also significantly higher odds, and risks of gestational diabetes mellitus [OR 4.3 (P=0.002), and RR 3.9 (P=0.003)], and preterm deliveries [OR 2.9 (P=0.02), and RR 2.7 (P=0.02)] compared to H. Pylori-negative controls.

**Conclusion:** The incidence of hyperemesis gravidarum, iron deficiency anemia, preeclampsia, gestational diabetes mellitus, and preterm deliveries was significantly higher in the studied H. Pylori-positive participants compared to non-infected controls. The H. Pylori-positive group had significantly higher odds, and risks of hyperemesis gravidarum, iron deficiency anemia, preeclampsia, gestational diabetes mellitus, and preterm deliveries compared to H. Pylori-negative controls.

**Background**

The *Helicobacter pylori* (H. pylori) is a gram-negative, oxidase and urease-positive bacteria, invading the gastric mucosa [1]. It is the most common bacterial illness with an incidence about 50% in developed
countries, and 80% in developing countries.

The H. pylori infection causes chronic gastritis, which may progress to gastric ulcer, and cancer [2]. The H. pylori affects 46% of pregnant women worldwide [1,3]. The hormonal, and immunological changes during pregnancy could increase the risk of H. pylori infection or could activate the latent H. pylori with subsequent adverse pregnancy outcomes [3].

H. pylori infection is associated with adverse pregnancy outcomes such as hyperemesis gravidarum (HG) [4], iron deficiency anemia (IDA) [2], preeclampsia (PE), gestational diabetes mellitus (GDM), and preterm deliveries (PTDs) [3].

The association between H. pylori infection, and adverse pregnancy outcomes is still controversial, and currently there are no available guidelines recommend screening for H. pylori infection before and/or during pregnancy. Therefore, this study designed to detect the incidence of H. pylori in Egyptian pregnant women, and the adverse pregnancy outcomes associated with H. pylori infection.

**Methods**

This prospective comparative study conducted during the years 2022 and 2023 after approval of the Research Ethics Committee of the Faculty of Medicine, Tanta university (Approval Code 35618/8/22).

Pregnant women attending the ante-natal care clinic, with regular antenatal follow-up at least twice/month, and complete delivery records were recruited for this study after informed consents following the Helsinki Declaration.

Women with irregular antenatal care, incomplete antenatal and/or delivery records, multiple pregnancies, pre-existing medical disorders (i.e., pre-pregnancy diabetes mellitus, and/or hypertension), iatrogenic PTD (due to medical disorders with pregnancy or due to obstetrics indications such as twins, or triplets), symptomatic gastroesophageal reflux, inflammatory bowel disease, or refused to participate were excluded from this study.

After through history (i.e., maternal age, and parity), and clinical examination (i.e., body mass index (BMI)), routine antenatal care was done for the studied participants following the hospital`s protocol.

The collected blood samples from the studied participants during their first antenatal visit were used for detection of anti-H. Pylori IgG. The extracted serum from participants’ blood samples were collected in clean Eppendorff tubes and stored at -20°C for detection of anti-H. Pylori IgG using the quantitative enzyme linked immunoassay technique (ELISA) kit (catalogue no. ab108736, abcam Inc., San Francisco, USA) [5].

Participants were categorized during the antenatal care according to anti-H. Pylori IgG to either H. Pylori-positive (study group), or H. Pylori-negative controls. Participants were followed-up in the antenatal
clinics till delivery to detect any adverse outcome either during pregnancy and/or during delivery (i.e., HG, IDA, GDM, PE, or PTDs).

The BMI was calculated from the participants’ body weight and their height (kg/m^2) [6]. HG is defined according to the WHO as persistent and/or excessive vomiting starting before the 22nd weeks’ gestation [7].

The diagnosis of IDA was based on serum ferritin <15 ug/L, Hemoglobin <10.9 g/dL, RBCs-MCV (Mean corpuscular volume) <80 fl, and RBCs-MCH (Mean corpuscular hemoglobin) <27 pg [8].

The IDA in pregnant women classified according to WHO into; severe anemia if Hb is <7 g/dL, moderate anemia if Hb is 7-8.9 g/dL, and mild anemia if Hb is 9-10.9 g/dL [8-9].

GDM is defined as glucose intolerance diagnosed for the first-time during pregnancy [10]. The American Diabetes Association recommends screening of pregnant women at 24-28 weeks’ gestation for GDM using the OGTT (oral glucose tolerance test) [10].

PE is defined as hypertension (blood pressure ≥140/90 mmHg on two separate occasions over at least 4-hrs.), and proteinuria after 20 weeks’ gestation without previous history of hypertension [11].

The gestational age was calculated according to the hospital’s protocol from the first day of the last menstrual period (LMP), and an early ultrasound scan (done ≤20 weeks’ gestation) [12].

The proteinuria is defined as ≥300 mg proteins/24-hrs. urine or protein/creatinine (P/C) ratio ≥0.3 [11].

PTDs is defined as delivery before 37 weeks’ gestation [13].

Collected data were statistically analyzed to detect the incidence of H. pylori in Egyptian pregnant women, and the adverse pregnancy outcomes associated with H. pylori infection.

**Sample size**

The sample size was calculated using the G Power software version 3.1.9.4, setting the probability at 0.05, power at 0.95%, and effective sample size at 0.3. An effective sample ≥220 women in two groups (H. Pylori-positive group, and H. Pylori-negative controls) was needed to produce an acceptable figure.

**Statistical analysis**

The collected data were statistically analyzed using the Statistical Package for Social Sciences (SPSS) version 20 (Chicago, IL, USA). The mean, and standard deviation (±SD) were used to present numerical values, while the number (n) and percentage (%) were used to present categorical values.

The Student t was used for analysis of quantitative data, and the Chi-square (x^2) test was used for analysis of qualitative data. The MedCalc 20.106 (MedCalc Software Ltd, Belgium) was used to calculate
the odd ratios (ORs), and relative risks (RRs) of adverse pregnancy outcomes associated with H. Pylori infection. \( P < 0.05 \) considered significant.

**Results**

Three hundred and twenty-seven (327) participants were recruited for this study, 22 were excluded (incomplete antenatal and/or delivery records), and data of 305 participants were finally analyzed (129 in H. Pylori-positive, and 176 in H. Pylori-negative controls), to detect the incidence of H. pylori in Egyptian pregnant women, and the adverse pregnancy outcomes associated with H. pylori infection. The anti-H. Pylori IgG antibodies were detected in 42.3% (129/305) of the studied participants (Figure 1).

There was no significant difference between the studied H. Pylori-positive group, and H. Pylori-negative controls regarding the maternal age (27.7 ± 2.6 versus 27.2 ± 2.7 years, respectively), \( (P = 0.7) \), parity (1.49 ± 1.0 versus 1.59 ± 1.1, respectively), \( (P = 0.8) \), and BMI (25.5 ± 1.15 versus 25.6 ± 1.22 Kg/m\(^2\), respectively), \( (P = 0.8) \), (Table 1).

The incidence of HG, IDA, and PE was significantly higher in the studied H. Pylori-positive group (8.5%, 34.9%, and 6.98%, respectively) compared to H. Pylori-negative controls (1.14%, 19.3%, and 1.7%, respectively), \( (P = 0.002, 0.01, \text{and } 0.02, \text{respectively}) \).

The incidence of GDM, and PTD was also significantly higher in the studied H. Pylori-positive group (13.18% and 10.9%, respectively) compared to H. Pylori-negative controls (3.4% and 3.98%, respectively), \( (P = 0.003 \text{ and } 0.02, \text{respectively}) \), (Table 1).

**The odds and risks of adverse pregnancy outcomes:** The H. Pylori-positive group had significantly higher odds, and risks of HG \[ \text{OR} 8.1 \text{ (} P = 0.007 \text{), and RR 7.5 (} P = 0.008 \text{)} \], IDA \[ \text{OR} 2.2 \text{ (} P = 0.002 \text{), and RR 1.8 (} P = 0.002 \text{)} \], and PE \[ \text{OR} 4.3 \text{ (} P = 0.03 \text{), and RR 4.1 (} P = 0.03 \text{)} \] compared to H. Pylori-negative controls.

The H. Pylori-positive group had also significantly higher odds, and risks of GDM \[ \text{OR} 4.3 \text{ (} P = 0.002 \text{), and RR 3.9 (} P = 0.003 \text{)} \], and PTD \[ \text{OR} 2.9 \text{ (} P = 0.02 \text{), and RR 2.7 (} P = 0.02 \text{)} \] compared to H. Pylori-negative controls (Table 2).

**Discussion**

Data of 305 participants were analyzed in this prospective comparative study; 129 in H. Pylori-positive group, and 176 in H. Pylori-negative controls to detect the incidence of H. pylori infection in Egyptian pregnant women, and the adverse pregnancy outcomes associated with H. pylori infection.

The anti-H. Pylori IgG antibodies were detected in 129 out of 305 of the studied participants. The incidence of H. pylori infection among the studied Egyptian pregnant women was 42.3% (129/305).

The prevalence of *H. pylori* in pregnancy varies between studies, based on the studied population and methods used to diagnose *H. pylori* [14].
The prevalence of *H. pylori* in pregnancy is about 20-30% in Europe [15], 50-70% in United States [16], and Turkey [17], and >80% in Egypt [18].

**H. pylori and hyperemesis gravidarum (HG):** The incidence of HG was significantly higher in the studied H. Pylori-positive group (8.5%) compared to H. Pylori-negative controls (1.14%), (P=0.002). The H. Pylori-positive group had significantly higher odds, and risks of HG [OR 8.1 (P=0.007), and RR 7.5 (P=0.008)] compared to H. Pylori-negative controls.

*Koçak et al*, found a significant association between the H. pylori infection and HG, and reported H. Pylori infection in 91.5% (87/95) of pregnant women with HG [5].

A positive relation between *H. pylori* and HG has been reported previously [19-21]. In addition, a systematic review reported increased odds of HG in *H. pylori*-positive participant compared to normal controls (OR 4.45; 95%CI: 2.31-8.54) [22].

**H. pylori and iron deficiency anemia (IDA):** The incidence of IDA was significantly higher in the studied H. Pylori-positive group (34.9%) compared to H. Pylori-negative controls (19.3%), (P=0.01). The H. Pylori-positive group had significantly higher odds, and risks of IDA [OR 2.2 (P=0.002), and RR 1.8 (P=0.002)] compared to H. Pylori-negative controls.

An association between IDA, and H pylori has been reported previously [23,24]. In addition, a meta-analysis, reported higher prevalence of IDA in *H. pylori*-positive participants compared to normal controls [25].

The IDA in *H. pylori*-infected participants could be explained by decreased iron absorption, low gastric pH, and increased hepcidin in response to interleukin-6 (IL-6) produced with *H. pylori* gastritis [14].

**H. pylori and preeclampsia (PE):** The incidence of PE was significantly higher in the studied H. Pylori-positive group (6.98%) compared to H. Pylori-negative controls (1.7%), (P=0.02). The H. Pylori-positive group had significantly higher odds, and risks of PE [OR 4.3 (P=0.03), and RR 4.1 (P=0.03)] compared to H. Pylori-negative controls.

Two case-control studies reported significantly higher *H. pylori* positive rate in PE compared to *H. pylori* negative controls [26,27].

*UstUn et al*, reported higher anti-*H. pylori* positive antibodies in PE compared to controls [26], and *Aksoy et al*, reported an 81% *H. pylori* sero-positive rate in PE [27].

*Ponzetto et al*, found the *H. pylori* seropositive rate was frequently higher in PE (51.1%) compared to controls (31.9%) [28].

A meta-analysis found the H. pylori infection during pregnancy was significantly related to increased risk of PE [1].
The association between H. pylori, and PE could be explained by the antibodies against *H. pylori*-CagA-positive strains (Cytotoxin-associated antigen-A), which cross-react with the placenta, and surface endothelial cells [29].

*Cardaropoli et al,* found the infection with *H. pylori*-CagA-positive strains could induce maternal inflammatory response, and abnormal placentation with subsequent development of PE [14].

**H. pylori and gestational diabetes (GDM):** The incidence of GDM was significantly higher in the studied *H. pylori*-positive group (13.18%) compared to *H. pylori*-negative controls (3.4%), (*P*=0.003). The *H. pylori*-positive group had significantly higher odds, and risks of GDM [OR 4.3 (*P*=0.002), and RR 3.9 (*P*=0.003)] compared to *H. pylori*-negative controls.

Although some studies reported an association between H. pylori infection, and insulin resistance (IR) [30-32], the association between H. pylori infection, and IR remains controversial [30].

The association between *H. pylori*, and GDM can be explained by the lipopolysaccharide, which released from the *H. pylori* membrane into the circulation causing low-grade inflammation, metabolic disturbance, IR with subsequent glucose intolerance [33].

*Patro-Malysza et al,* explained the association between the *H. pylori*, and GDM by the *H. pylori* induced inflammatory cytokines, which could disrupt the phosphorylation of insulin receptor [34].

A prospective cohort study found the *H. pylori* infection significantly increase the incidence of metabolic disorders, and GDM (especially in pregnant women with high BMI) [35].

A cross-sectional study reported a significantly higher risk of DM among *H. pylori* infected participants compared to *H. pylori* negative controls [36].

*Cardaropoli et al,* in a cohort study found the presence of antibodies against *H. pylori* in maternal serum was independently associated with the development of GDM [37]. In addition, a meta-analysis found the *H. pylori* infection during pregnancy was significantly associated with increased risk of GDM [1].

**H. pylori and preterm deliveries (PTDs):** Although, *den Hollander et al,* and *Mackenna et al,* found the *H. pylori* infection was not associated with PTD [38, 39].

The incidence of PTDs was significantly higher in the studied *H. pylori*-positive group (10.9%) compared to *H. pylori*-negative controls (3.98%), (*P*=0.02). The *H. pylori*-positive group had significantly higher odds, and risks of PTDs [OR 2.9 (*P*=0.02), and RR 2.7 (*P*=0.02)] compared to *H. pylori*-negative controls.

*Yang et al,* found the antibodies against *H. pylori*-CagA-positive strains, and *H. pylori*-VacA-positive strains (Vacuolating cytotoxin-A) significantly increased in women with spontaneous PTDs [40].

*Yang et al,* reported a significant association between the antibodies against *H. pylori* in maternal serum, and spontaneous PTDs [40].
The association between H. pylori infection, and PTDs remains controversial, which needs to be confirmed in future studies.

This study found the incidence of hyperemesis gravidarum, iron deficiency anemia, preeclampsia, gestational diabetes mellitus, and preterm deliveries was significantly higher in the studied H. Pylori-positive group compared to non-infected controls. The studied H. Pylori-positive group had significantly higher odds, and risks of hyperemesis gravidarum, iron deficiency anemia, preeclampsia, gestational diabetes mellitus, and preterm deliveries compared to H. Pylori-negative controls.

This study suggests screening and treating H. pylori infection before pregnancy to avoid the H. pylori associated adverse pregnancy outcomes.

This study was the first prospective comparative study conduct to detect the incidence of H. pylori in Egyptian pregnant women, and the adverse pregnancy outcomes associated with H. pylori infection.

Women refused to participate, incomplete antenatal and/or delivery records (22 women excluded) were the limitations of this study.

**Conclusion**

The incidence of hyperemesis gravidarum, iron deficiency anemia, preeclampsia, gestational diabetes mellitus, and preterm deliveries was significantly higher in the studied H. Pylori-positive participants compared to non-infected controls. The H. Pylori-positive group had significantly higher odds, and risks of hyperemesis gravidarum, iron deficiency anemia, preeclampsia, gestational diabetes mellitus, and preterm deliveries compared to H. Pylori-negative controls.

**Abbreviations**

BMI: Body mass index.

CagA: Cytotoxin-associated antigen-A.

ELISA: Enzyme linked immunoasssay technique.

GDM: Gestational diabetes mellitus.

H. pylori: Helicobacter pylori.

HG: Hyperemesis gravidarum.

IDA: Iron deficiency anemia.

IgG: Immunoglobulins-G.
IL-6: Interleukin-6.
IR: Insulin resistance.
LMP: Last menstrual period.
OGTT: Oral glucose tolerance test.
OR: Odd Ratio.
P/C: Protein/creatinine.
PE: Preeclampsia.
PTDs: Preterm deliveries.
RR: Relative Risk.
SPSS: Statistical Package for Social Sciences.
VacA: H. Pylori Vacuolating cytotoxin-A.
VacA: Vacuolating cytotoxin-A.

Declarations

1. Ethics approval and consent to participate: Participants were included in this study after approval of the Research Ethics Committee of the Faculty of Medicine, Tanta university (Approval Code 35618/8/22). Participants were included in this study after informed consent following the Helsinki Declaration. All experiments done in this study were performed in accordance with the Declaration of Helsinki.

2. Consent for publication: Not applicable

3. Availability of data and materials: All data generated or analysed during this study were included and submitted for review with the study.

4. Competing interests: Authors declare no conflict of interests related to this study.

5. Funding: Not applicable

6. Authors` contribution

AMH principal investigator, designed the study, participants’ evaluation (i.e., including history, clinical examination, and routine antenatal care), laboratory test using the enzyme linked immunoassay technique to detect the anti-H. Pylori IgG, collected the participants’ data, and revised the manuscript before submission.
IAA corresponding author, reviewed the literature, updated the references, edited, and statistically analyzed the participants’ data, and revised the manuscript before publication.

AMA designed the study, participants’ evaluation (i.e., including history, clinical examination, and routine antenatal care), laboratory test using the enzyme linked immunoassay technique to detect the anti-H. Pylori IgG, collected the participants’ data, and revised the manuscript before submission.

NAH participants’ evaluation (i.e., including history, clinical examination, and routine antenatal care), collected the participants’ data, and revised the manuscript before submission.

IIS reviewed the literature, updated the references, edited, and statistically analyzed the participants’ data, and revised the manuscript before publication.

NE participants’ evaluation (i.e., including history, clinical examination, and routine antenatal care), collected the participants’ data, and revised the manuscript before submission.

All authors read, revised and approved the final manuscript.

7. Acknowledgments: The authors are grateful to the participants for giving consent and participation in this study.

References


Tables

**Table 1:** Characteristics, and the adverse pregnancy outcomes of the two-studied groups
<table>
<thead>
<tr>
<th>Variable</th>
<th>H. Pylori-positive group (N=129)</th>
<th>H. Pylori-negative controls (N=176)</th>
<th>P value (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal age (Years)</td>
<td>27.7 ± 2.6</td>
<td>27.2 ± 2.7</td>
<td>0.7 (-0.10, 0.5, 1.10)</td>
</tr>
<tr>
<td>Parity</td>
<td>1.49 ± 1.0</td>
<td>1.59 ± 1.1</td>
<td>0.8 (-0.34, -0.1, 0.14)</td>
</tr>
<tr>
<td>BMI (Kg/m²)</td>
<td>25.5 ± 1.15</td>
<td>25.6 ± 1.22</td>
<td>0.8 (-0.4, -0.1, 0.17)</td>
</tr>
<tr>
<td>Hyperemesis Gravidarum (HG)</td>
<td>11/129 (8.5%)</td>
<td>2/176 (1.14%)</td>
<td>0.002*</td>
</tr>
<tr>
<td>Iron deficiency anemia (IDA)</td>
<td>45/129 (34.9%)</td>
<td>34/176 (19.3%)</td>
<td>0.01*</td>
</tr>
<tr>
<td>Preeclampsia (PE)</td>
<td>9/129 (6.98%)</td>
<td>3/176 (1.7%)</td>
<td>0.02*</td>
</tr>
<tr>
<td>Gestational diabetes (GDM)</td>
<td>17/129 (13.18%)</td>
<td>6/176 (3.4%)</td>
<td>0.003*</td>
</tr>
<tr>
<td>Preterm deliveries (PTDs)</td>
<td>14/129 (10.9%)</td>
<td>7/176 (3.98%)</td>
<td>0.02*</td>
</tr>
</tbody>
</table>

BMI: Body Mass index. Chi-square ($x^2$) test used for statistical analysis when data presented as number and percentage (%).

CI: Confidence interval. Data presented as mean and standard deviation (SD) and number (n) and percentage (%).

H. Pylori: Helicobacter pylori. Student t test used for statistical analysis when data presented as mean ± SD.

Table 2: The odds and risks of adverse pregnancy outcomes associated with H. Pylori infection
<table>
<thead>
<tr>
<th>Variable</th>
<th>H. Pylori-positive group (N=129)</th>
<th>H. Pylori-negative controls (N=176)</th>
<th>OR [P-value (95% CI)]</th>
<th>RR [P-value (95% CI)]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hyperemesis Gravidarum (HG)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Positive</td>
<td>11</td>
<td>2</td>
<td>8.1 [0.007* (1.8 - 37.3)]</td>
<td></td>
</tr>
<tr>
<td>- Negative</td>
<td>118</td>
<td>174</td>
<td>7.5 [0.008* (1.7 - 33.3)]</td>
<td></td>
</tr>
<tr>
<td><strong>Iron deficiency anemia (IDA)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Positive</td>
<td>45</td>
<td>34</td>
<td>2.2 [0.002* (1.3 - 3.8)]</td>
<td></td>
</tr>
<tr>
<td>- Negative</td>
<td>84</td>
<td>142</td>
<td>1.8 [0.002* (1.2 - 2.6)]</td>
<td></td>
</tr>
<tr>
<td><strong>Preeclampsia (PE)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Positive</td>
<td>9</td>
<td>3</td>
<td>4.3 [0.03* (1.15 - 16.3)]</td>
<td></td>
</tr>
<tr>
<td>- Negative</td>
<td>120</td>
<td>173</td>
<td>4.1 [0.03* (1.13 - 14.8)]</td>
<td></td>
</tr>
<tr>
<td><strong>Gestational diabetes (GDM)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Positive</td>
<td>17</td>
<td>6</td>
<td>4.3 [0.002* (1.65 - 11.2)]</td>
<td></td>
</tr>
<tr>
<td>- Negative</td>
<td>112</td>
<td>170</td>
<td>3.9 [0.003* (1.6 - 9.5)]</td>
<td></td>
</tr>
<tr>
<td><strong>Preterm deliveries (PTD)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Positive</td>
<td>14</td>
<td>7</td>
<td>2.9 [0.02* (1.15 - 7.5)]</td>
<td></td>
</tr>
<tr>
<td>- Negative</td>
<td>115</td>
<td>169</td>
<td>2.7 [0.02* (1.13 - 6.6)]</td>
<td></td>
</tr>
</tbody>
</table>


**Figures**
Recruited participants (327)
(22 Excluded and 305 participants' data were finally analyzed)

H. Pylori-positive (129)
- Hyperemesis Gravidarum (8.5%)
- Iron deficiency anemia (34.9%)
- Gestational diabetes (13.18%)
- Preeclampsia (6.98%)
- Preterm delivery (10.9%)

H. Pylori-negative (176)
- Hyperemesis Gravidarum (1.14%)
- Iron deficiency anemia (19.3%)
- Gestational diabetes (3.4%)
- Preeclampsia (1.7%)
- Preterm delivery (3.98%)

Figure 1
Flow chart and the adverse outcomes of H. Pylori-positive participants versus H. Pylori-negative controls